

ABSTRACT

A method of forming an aligned dual damascene opening, comprising including the following sequential steps. A structure having a metal structure formed thereover is provided. A layer stack is formed over the metal structure. The layer stack comprises, in ascending order: a bottom etch stop layer; a lower dielectric material layer; a middle etch stop layer; a middle dielectric material layer; and an upper dielectric layer. The upper dielectric layer is patterned to form an opening exposing a portion of the underlying middle dielectric material layer. The opening having a width. A patterned mask layer is formed over the patterned upper dielectric layer leaving exposed opposing portions of the patterned upper dielectric layer. The middle dielectric material layer is patterned to form an opening therein using the patterned mask layer and the exposed portions of the upper dielectric layer as masks. The middle dielectric material layer opening exposing a portion of the middle etch stop layer. The middle etch stop layer is removed at its exposed portion to form a patterned middle etch stop layer having an opening exposing a portion of the lower dielectric material layer. Simultaneously patterning: the patterned middle dielectric material layer using the patterned upper dielectric layer as a mask to form an inchoate upper trench opening; and the lower dielectric material layer using the patterned mask layer and the patterned middle etch stop layer as masks to form an inchoate lower via opening aligned with the inchoate upper trench opening. The inchoate lower via opening exposing a portion of the underlying bottom etch stop layer. The patterned mask layer is removed. The patterned upper dielectric material layer, the exposed portions of the patterned

middle etch stop layer and the exposed portion of the bottom etch stop layer are removed to convert: the inchoate upper trench opening into a final upper trench opening; and the inchoate lower via opening into a final lower via opening to form the dual damascene opening.